Barrier Shrink film
**Adding function to fresh meat packaging**

Shrink film and bags are widely used for packaging fresh meat. When heat is applied the film/bag shrinks to fit firmly around the portion of meat, adapting itself to the individual shape.

EVAL™ EVOH resins have gas barrier properties nearly 10,000 times greater than those of an equivalent thickness of low density polyethylene (LDPE). An EVAL™ layer of only a few microns in a multilayer structure adds a powerful and effective barrier function against gas and aroma. Oxygen is kept out to avoid spoilage, flavour is locked inside where it belongs.

Technological innovation has created the world’s widest range of available EVOH grades, suitable for the production and secondary processing of fresh food packaging.

**EVAL™ SP types** are orientable, and especially suited to double bubble processing. They offer superior barrier properties while maintaining desired clarity and shrink ratios.

**EVAL™ G type** has a higher ethylene content, which allows excellent flexibility and easy processing.

**EVAL™ H type** combines high barrier properties with long-term run stability and thermoformability. The higher ethylene content allows easier processing and longer running times on older coextrusion equipment, especially for blown flexible structures.

**EVAL™ EVOH resins**

EVAL™ is the registered trademark for Ethylene Vinyl-Alcohol (EVOH) copolymer resins manufactured and marketed by Kuraray since 1972.

<table>
<thead>
<tr>
<th>Type</th>
<th>EVAL™ SP482B</th>
<th>EVAL™ SP292B</th>
<th>EVAL™ G156B</th>
<th>EVAL™ H171B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethylene content (mol%)</td>
<td>32</td>
<td>44</td>
<td>48</td>
<td>38</td>
</tr>
<tr>
<td>Density (g/cm³)</td>
<td>1.16</td>
<td>1.13</td>
<td>1.12</td>
<td>1.17</td>
</tr>
<tr>
<td>MFR (g/10 min)</td>
<td>2.0</td>
<td>2.1</td>
<td>6.9</td>
<td>1.7</td>
</tr>
<tr>
<td>Tm (°C)</td>
<td>181</td>
<td>161</td>
<td>160</td>
<td>172</td>
</tr>
<tr>
<td>Tg (°C)</td>
<td>41</td>
<td>48</td>
<td>50</td>
<td>53</td>
</tr>
<tr>
<td>OTR (cc·20µm/m²·day·atm)</td>
<td>0.6</td>
<td>3.1</td>
<td>3.2</td>
<td>0.7</td>
</tr>
</tbody>
</table>

(1) 20°C (2) 190°C, 2160g (3) dry (4) OTR, 20°C, 65% RH (ISO 14663-2)

**Typical double bubble blown film process.**

Shrink film/bags are convenient since standard sized bags adapt themselves to the individual sizes of each portion. They provide clarity and enhance the appearance of the packaged meat. They are tamper evident and maintain product quality. By adding a high barrier layer of EVAL™ to the shrink film/bag structure, oxygen permeation is blocked and shelf life is extended. The packaged product retains its freshness longer, protecting value and reducing waste.

In order to achieve a sufficient shrink ratio, so called “double bubble” blown film coextrusion is increasingly popular. The coextruded blown film structure is heated and blown a second time, ensuring desired shrinkage when the film/bag is subsequently heated when packaging. In the past, this secondary orientation was technically challenging for EVOH, which is a relatively stiff material. However, Kuraray has developed the orientable EVAL™ SP grade series, which significantly widen EVAL™’s processing window, and make them suitable for this process without compromising on barrier properties.

EVAL™ SP types are orientable, and especially suited to double bubble processing. They offer superior barrier properties while maintaining desired clarity and shrink ratios.

**EVAL™ H type** combines high barrier properties with long-term run stability and thermoformability. The higher ethylene content allows easier processing and longer running times on older coextrusion equipment, especially for blown flexible structures.

Shrink film/bags are convenient since standard sized bags adapt themselves to the individual sizes of each portion. They provide clarity and enhance the appearance of the packaged meat. They are tamper evident and maintain product quality. By adding a high barrier layer of EVAL™ to the shrink film/bag structure, oxygen permeation is blocked and shelf life is extended. The packaged product retains its freshness longer, protecting value and reducing waste.

In order to achieve a sufficient shrink ratio, so called “double bubble” blown film coextrusion is increasingly popular. The coextruded blown film structure is heated and blown a second time, ensuring desired shrinkage when the film/bag is subsequently heated when packaging. In the past, this secondary orientation was technically challenging for EVOH, which is a relatively stiff material. However, Kuraray has developed the orientable EVAL™ SP grade series, which significantly widen EVAL™’s processing window, and make them suitable for this process without compromising on barrier properties.

**EVAL™ EVOH resins**

EVAL™ is the registered trademark for Ethylene Vinyl-Alcohol (EVOH) copolymer resins manufactured and marketed by Kuraray since 1972.
High performance, prolonged freshness, reduced waste

EVAL™ resins’ functional barrier blocks oxygen permeation into shrink film packaging. This makes it possible to protect value and extend product shelf life by limiting bacteriological growth. Prolonging freshness and avoiding waste brings welcome flexibility and cost savings to the distribution chain.

Currently PVDC shrink structures are commonly used for packaging fresh meat, especially for intermediate processing and distribution that is often not seen by the end consumer.

EVAL™ offers an effective alternative choice to PVDC, with barrier properties that provide similar protective performance for shrink film. Due to orientation, the barrier properties of EVAL™ resins actually improve with shrink treatment. This is most visible with the orientable SP grade series. The barrier properties are so good that it is often possible to reduce the amount of raw materials used without compromising on value protection.

<table>
<thead>
<tr>
<th>Storage time (day)</th>
<th>SP Based</th>
<th>PVDC Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>1,000</td>
<td>1,000</td>
</tr>
<tr>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>100,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>1,000,000</td>
<td>1,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>10,000,000</td>
<td>10,000,000</td>
<td>10,000,000</td>
</tr>
</tbody>
</table>

Shrink performance of EVAL™ resins

EVAL™ layer shrinks similarly to other polyolefins in a multilayer structure. This ensures a reliable barrier layer, without compromising on haze or clarity due to layer instability.

Cross section of multilayer structure after shrink

Barrier performance before and after shrink

The EVAL™ layer shrinks similarly to other polyolefins in a multilayer structure. This ensures a reliable barrier layer, without compromising on haze or clarity due to layer instability.

Cross section of multilayer structure after shrink

EVAL™ SP based

PVDC based
Appearance

Exceptional clarity

EVAL™ contains relatively low haze, providing excellent clarity and fresh appearance to shrink film packaging. Compared to PVDC, appearance is further enhanced by its relatively low Yellow Index (YI).

Haze and Yellow index

Shrink Tension

Compared to PVDC, EVAL™ has a slightly lower shrink tension. This means that barrier shrink structures with EVAL™ fit firmly to packaged meat, but will not squeeze too tightly, which tends to force unsightly fluids into the edges of the package. Combined with the exceptional clarity of EVAL™, product attractiveness is further enhanced without compromising on function and protection of quality.

Effect of shrink tension and yellow index on product appearance

PVDC based  EVAL™ SP based  PVDC based  EVAL™ SP based
Reducing environmental impact with EVAL™ resins

Functional, recyclable and recoverable

A one millimetre thickness of EVAL™ EVOH has about the same gas barrier properties as ten metres of LDPE. With such high performance, EVAL™ layers of only a few microns can add real function to multilayer structures.

Barrier performance previously only available from metal or glass can thus be added to light weight structures based on other recyclable and energy recoverable plastics, or renewable resources like PLA and paperboard.

Although product development tends to focus specifically on EVAL™’s functional barrier properties, EVAL™ helps conserve resources and avoid waste throughout a product’s life cycle. Reducing waste, and thus avoiding the loss of all resources invested in the production and distribution of fresh food, is the best way to reduce environmental impact.

When used in shrink film packaging, EVAL™ layers of just a few microns allow to use fewer resources while providing valuable barrier function. Optimized portion size, light weight and extended freshness help improve the efficiency of storage, transport and display, saving costs and preserving resources.

EVAL™ EVOH is recyclable, and will not disrupt polyolefin or PET recycling streams.

EVAL™ has excellent and safe energy recovery properties, often reducing the amount of extra fuel necessary for energy generation from the thermal disposal of sorted waste.

Under perfect combustion, the few microns of EVAL™ in the package emit only small amounts of CO$_2$ and water vapour.
Introducing Kuraray and EVAL™

Kuraray and EVAL™

Kuraray Co., Ltd. was established in 1926 in Kurashiki, Japan, for the industrial manufacture of chemical fibres. As the world’s largest producer of vinyl acetate monomer (VAM) derivatives, Kuraray has long been a leader in high gas barrier technology and development. Today the Kuraray Group consists of about 70 companies, employing around 7,000 people worldwide.

Kuraray has been manufacturing and marketing ethylene vinyl-alcohol copolymers (EVOH) under the name EVAL™ since 1972, and remains the world leader in EVOH production and market development. EVAL™ is one of Kuraray’s core businesses and is produced globally in Japan, the USA and Europe. The sales and technical development of EVAL™ is supported by specialised local teams in each region.

Building better barriers

EVAL™ adds superior barrier functionality to multilayer plastic structures. Since 1mm of EVAL™ provides about the same gas barrier properties as a 10 metre thickness of LDPE, even very thin EVAL™ layers provide excellent results. EVAL™ is widely used as a functional gas and flavour/aroma barrier in food, medical, pharmaceutical and cosmetic packaging, and as a gas and solvent barrier in industrial, construction, agricultural and automotive fuel system applications.
EVAL™ the world’s leading EVOH

Europe
EVAL Europe nv (Antwerp, Belgium)
Capacity: 24,000 tons/year
Europe’s first and largest EVOH production facility

Americas
EVAL Company of America (Pasadena, Texas, USA)
Capacity: 35,000 tons/year
The world’s largest EVOH production facility

Asia-Pacific
Kuraray Co., Ltd. (Okayama, Japan)
Capacity: 10,000 tons/year
The world’s first EVOH production facility

NOTICE
The information, specifications, procedures, methods and recommendations herein are presented in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. No representation, guarantee or warranty is made as to the completeness of said information, specifications, procedures, methods and recommendations or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe patents of others or give desired results. Readers are cautioned to satisfy themselves as to the suitability of said information, specifications, procedures, methods and recommendations for the purpose intended prior to use.

Contact
EVAL Europe nv
Haven 1053
Nieuwe Weg 1 - Bus 10
B-2070 Zwijndrecht (Antwerp)
Belgium

Telephone +32 3 250 97 33
Fax +32 3 250 97 45
www.eval.eu

EVAL™ resins are produced worldwide under unified Kuraray product and quality specifications. SHR.OCT.2010 Copyright Kuraray Co., Ltd.